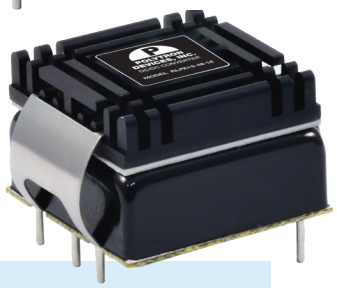
POLYTRON DEVICES

DATA SHEET



DC-DC CONVERTERS

REGULATED, 2:1 WIDE INPUT RANGE UP TO 15 WATTS

RAILWAY APPLICATIONS, MINIATURE, LOW PROFILE, SINGLE & DUAL OUTPUT

RLPA15 SERIES

cULus CE CB

FEATURES

- 2:1 Wide Input Voltage Range
- High Efficiency Up to 91%
- Miniature and Low Profile Package: 1.0" × 1.0" × 0.39"
- High Isolation Option: 3000Vdc
- Internal EN55032 Class A Filter
- Low Standby Power
- High Reliability Power
- Remote ON/OFF
- Over Current Protection
- Over Voltage Protection
- Short Circuit Protection
- Under Voltage Protection
- Six Sided Continuous Shield
- EN50155 and EN45545-2 Railway Standard
- Safety Meets UL60950-1, EN60950-1, IEC60950-1, UL62368-1, EN62368-1 and IEC62368-1
- CE Mark
- Compliant to RoHS & Reach

SELECTION GUIDE All specifications are typical at nominal input, full load and 25°C, unless otherwise noted.

Input Voltage Range Vdc	Output Voltage Vdc	Output Current at Full Load mA	Input Current at No Load mA	Efficiency %	Model Number	Maximum Capacitor Load µF
9 - 18	3.3	4500	8	88	RLPA15-24S33	5200
9 - 18	5	3000	8	90	RLPA15-24S5	3600
9 - 18	12	1300	8	89	RLPA15-24S12	600
9 - 18	15	1000	10	90	RLPA15-24S15	500
9 - 18	24	625	10	91	RLPA15-24S24	200
18 - 36	3.3	4500	8	88	RLPA15-48S33	5200
18 - 36	5	3000	8	90	RLPA15-48S5	3600
18 - 36	12	1300	8	89	RLPA15-48S12	600
18 - 36	15	1000	8	90	RLPA15-48S15	500
18 - 36	24	625	8	91	RLPA15-48S24	200
36 - 75	3.3	4500	7	87	RLPA15-110S33	5200
36 - 75	5	3000	7	89	RLPA15-110S5	3600
36 - 75	12	1300	7	89	RLPA15-110S12	600
36 - 75	15	1000	7	89	RLPA15-110S15	500
36 - 75	24	625	7	90	RLPA15-110S24	200
9 - 18	±5	±1500	10	86	RLPA15-24-5	±1500
9 - 18	±12	±625	10	90	RLPA15-24-12	±360
9 - 18	±15	±500	14	90	RLPA15-24-15	±250
9 - 18	±24	±315	14	90	RLPA15-24-24	±100
18 - 36	±5	±1500	8	86	RLPA15-48-5	±1500
18 - 36	±12	±625	8	90	RLPA15-48-12	±360
18 - 36	±15	±500	9	90	RLPA15-48-15	±250
18 - 36	±24	±315	9	90	RLPA15-48-24	±100
36 - 75	±5	±1500	7	85	RLPA15-110-5	±1500
36 - 75	±12	±625	7	89	RLPA15-110-12	±360
36 - 75	±15	±500	7	89	RLPA15-110-15	±250
36 - 75	±24	±315	7	89	RLPA15-110-24	±100

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RLPA15 SERIES

Input Specifications

Operating input voltage range, Vdc	9 Min., 12 Typ., 18 Max.	12Vin(nom)
	18 Min., 24 Typ., 36 Max.	24Vin(nom)
	36 Min., 48 Typ., 75 Max.	48Vin(nom)
Start up voltage, Vdc	9 Max.	12Vin(nom)
	18 Max.	24Vin(nom)
	36 Max.	48Vin(nom)
Shutdown voltage, Vdc	7.5 Min., 8 Typ., 8.8 Max.	12Vin(nom)
	15.5 Min., 16 Typ., 17.5 Max.	24Vin(nom)
	32.5 Min., 33 Typ., 35.5 Max.	48Vin(nom)
Start up time, ms		Constant resistive load
	30 Typ., 40 Max.	Power up
	30 Typ., 40 Max.	Remote ON/OFF
Input surge voltage, Vdc		1 second, max.
	25 Max.	12Vin(nom)
	50 Max.	24Vin(nom)
	100 Max.	48Vin(nom)
Input filter	Pi type	
Remote ON/OFF		Referred to -Vin pin
	Open or 3 - 15 Vdc	Positive logic, DC-DC ON
	Short or 0 - 1.2 Vdc	(Option), DC-DC OFF
	Short or 0 - 1.2 Vdc	Negative logic, DC-DC ON
	Open or 3 - 15 Vdc	(Standard), DC-DC OFF
	-0.5 Min., 1 Max., mA	Input current of Ctrl pin
	1.5 mA Typ.	Remote off input current

Output Specifications

Voltage accuracy, %	-1.0 Min., +1.0 Max	
Line regulation, %		Low Line to High Line at Full Load
	-0.2 Min., +0.2 Max.	Single
	-0.5 Min., +0.5 Max.	Dual
Load regulation, %	-0.2 Min., +0.2 Max.	No Load to Full Load, Single
	-1.0 Min., +1.0 Max.	No Load to Full Load, Dual
	-0.1 Min., +0.1 Max.	10% Load to 90% Load, Single
	-0.8 Min., +0.8 Max.	10% Load to 90% Load, Dual
Cross regulation, %	-5.0 Min., +5.0 Max.	Asymmetrical load 25%/100%FL, Dual
Voltage and adjustability, %	-10 Min., +20 Max.	Single Output, 15Vout, 24Vout
	-10 Min., +10 Max.	Others
Ripple and noise, mVp-p		Measured by 20MHz bandwidth
	75 Typ.	Single, With a 10µF/6.3V X7R MLCC, 3.3Vout, 5Vout
	100 Typ.	Single, With a 1µF/25V X7R MLCC, 12Vout, 15Vout
	125 Typ.	Single, With a 2.2µF/50V X7R MLCC, 24Vout
	75 Typ.	Dual, With a 10µF/6.3V X7R MLCC for each output, 5Vout
	100 Typ.	Dual, With a 1µF/25V X7R MLCC for each output, 12Vout, 15Vout
	125 Typ.	Dual, With a 2.2µF/50V X7R MLCC for each output, 24Vout
Temperature coefficient, %/°C	-0.02 Min., -0.02 Max.	
Transient response recovery time, µs	250 Typ.	25% load step change
Over voltage protection, Vdc	3.7 Min., 5.4 Max.	3.3Vout
	5.6 Min., 7.0 Max.	5Vout
	13.5 Min., 19.6 Max.	12Vout
	18.3 Min., 22.0 Max.	15Vout
	29.1 Min., 32.5 Max.	24Vout
Over load protection, %	120 Min., 150 Typ., 190 Max.	% of Iout rated
Short circuit protection	Continuous, automatics recovery	

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RLPA15 SERIES

General Specifications

Isolation voltage, Vdc	1 minute	Input to Output, Standard Type	1600 Min.		
		Input to Output, Suffix "H"	3000 Min.		
		Input (Output) to Case, Standard Type	1000 Min.		
		Input (Output) to Case, Suffix "H"	1600 Min.		
Isolation resistance, GΩ	500Vdc		1 Min.		
Isolation capacitance, pF					2000 Max.
Switching frequency, kHz		3.3Vout, 5Vout	220 Min.	245 Typ.	270 Max.
		Others	270 Min.	300 Typ.	330 Max.

Environmental Specifications

Operating ambient temperature, °C	Standard type, with derating	-40 Min.		+105 Max.
	M3 version, with derating	-55 Min.		+105 Max.
Maximum case temperature, °C				+105 Max.
Storage temperature range, °C		-55 Min.		+125 Max.
Thermal impedance, °C/W	Without heat-sink		+17 Typ.	
	With heat-sink		+15.3 Typ.	
Thermal shock		MIL-STD-810F		
Shock		MIL-STD-810F		
Vibration		MIL-STD-810F		
Relative humidity		5% to 95% RH		

Physical Specifications

Design meet safety standard	UL60950-1, EN60950-1, IEC60950-1, UL62368-1, EN 62368-1, IEC 62368-1, EN50155, EN45545-2, UL:E193009, CB:UL(Demko)
Case material	Copper
Base material	FR4 PCB
Potting material	Silicone (UL94 V-0)
Weight	16.5g (0.58oz)
MTBF	1.672×10^6 hrs, MIL-HDBK-217F, Full load

EMC Specifications

Specifications	Conditions		Level
EMI	EN55032, EN55011	Without external components	Class A
		With external components	Class B
ESD	EN61000-4-2	Air ±8kV and Contact ±6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3	10V/m	Perf. Criteria A
Fast transient	EN61000-4-4	±2kV	Perf. Criteria A
Surge	EN61000-4-5	±1kV	Perf. Criteria A
Conducted immunity	EN61000-4-6	10 Vr.m.s	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8	100A/m continuous; 1000A/m 1 second	Perf. Criteria A

Note:

1. Test by minimum input and constant resistive load.
2. Trimming allows the user to increase or decrease the output voltage set point of the module. This is accomplished by connecting an external resistor between the Trim pin and either the +Vout pin or the -Vout pin.
3. The standard modules meet EN55032 Class A and Class B with external components.
   For further information, please contact Polytron Devices.
4. For RLPA15-12XXX: With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 470uF/50V) and a TVS (SMDJ58A, 58V, 3000Watt peak pulse power) in parallel.
   For RLPA15-24XXX: With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 470uF/50V) and a TVS (SMDJ70A, 70V, 3000Watt peak pulse power) in parallel.
   For RLPA15-48XXX: With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 220uF/100V) and a TVS (SMDJ100A, 100V, 3000Watt peak pulse power) in parallel.

CAUTION: This power module is not internally fused. An input line fuse must always be used.

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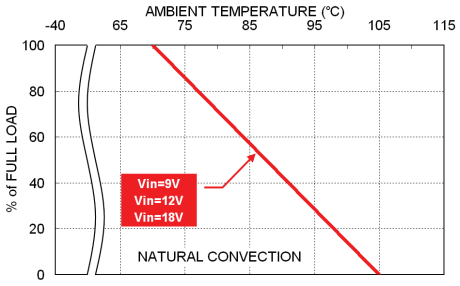
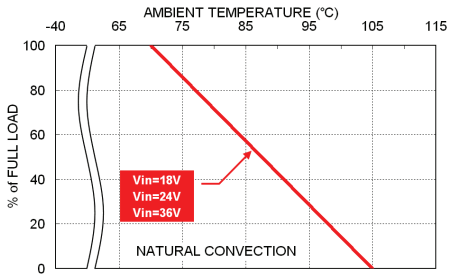
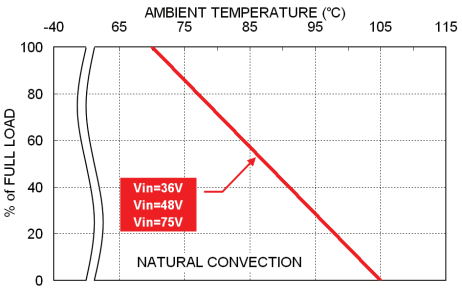
Characteristic Curve



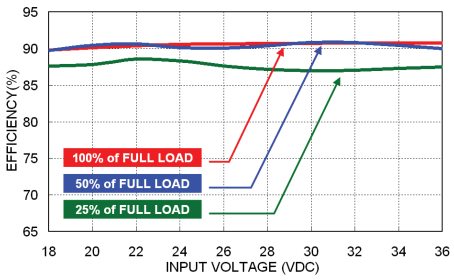
RLPA15-24XXX Derating Curve



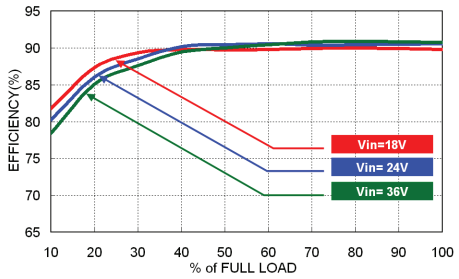
RLPA15-48XXX Derating Curve



RLPA15-110XXX Derating Curve



Efficiency vs. Input Voltage



Efficiency vs. Output Load

Fuse Consideration

Modules	Fuse Rating (A)	Fuse Type
RLPA15-24XXX	3.15	Slow-Blow
RLPA15-48XXX	1.6	Slow-Blow
RLPA15-110XXX	0.8	Slow-Blow

Note:

1. This power module is not internally fused. An input line fuse must always be used.
2. This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.
3. To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.
4. The table is based on the information provided in this data sheet on inrush energy and maximum DC input current at low Vin.

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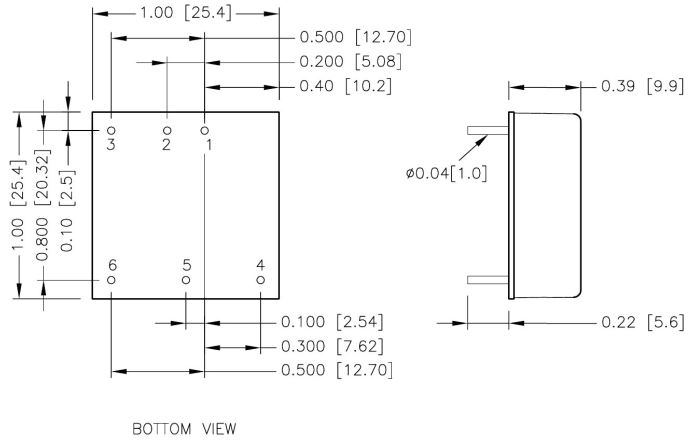
Mechanical Drawing



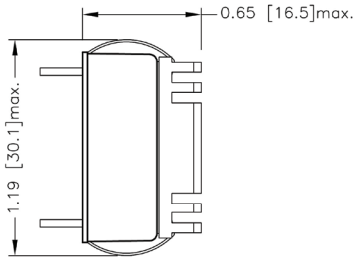
PIN CONNECTION

PIN	SINGLE	DUAL
1	+Vin	+Vin
2	-Vin	-Vin
3	Ctrl	Ctrl
4	+Vout	+Vout
5	Trim	Common
6	-Vout	-Vout

1. All dimensions in inch (mm)
2. Tolerance: x.xx±0.02 (x.x±0.5)x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)

Heat-Sink Options

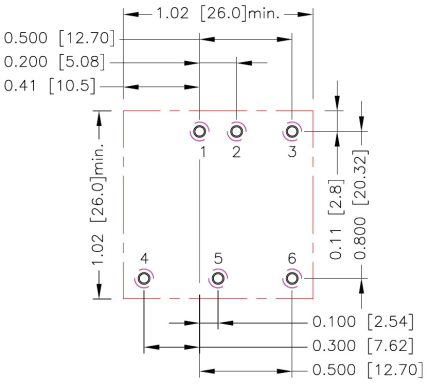
Heat Sink with clamps (Suffix “HC”)



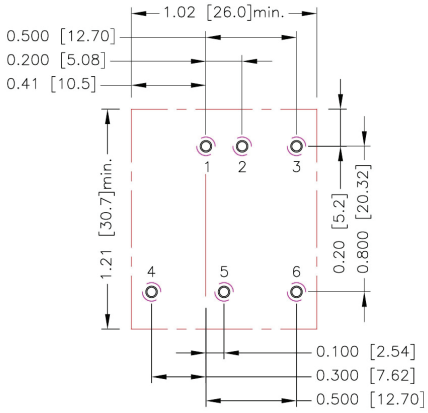
1. All dimensions in inch (mm)

Recommended Pad Layout

Standard



Heat Sink with clamps (Suffix “HC”)



1. All dimensions in inch (mm)
2. Pad size (lead free recommended)
3. Through hole 1, 2, 3, 4, 5, 6: 0.051 (1.30)
4. Top view pad 1, 2, 3, 4, 5, 6: 0.064 (1.63)
5. Bottom view pad 1, 2, 3, 4, 5, 6: 0.102 (2.60)

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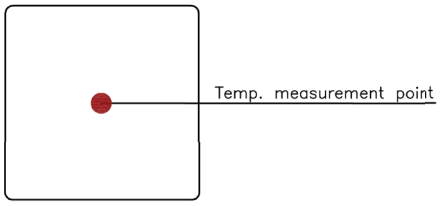
Thermal Considerations



1. The power module operates in a variety of thermal environments.
2. Sufficient cooling should be provided to help ensure reliable operation of the unit.
3. Heat is removed by conduction, convection and radiation to the surrounding environment.
4. Proper cooling can be verified by measuring the point.
5. The temperature at this location should not exceed “Maximum case temperature”.
6. When operating, adequate cooling must be provided to maintain the test point temperature at or below “Maximum case temperature”.
7. You can limit this temperature to a lower value for extremely high reliability.
8. Thermal test condition with vertical direction by natural convection (20LFM).

Output Voltage Adjustment

Trim Up Equation

$$R_U = \left[\frac{G \times L}{(V_{O,up} - L - K)} - H\right]\Omega$$

Trim Down Equation

$$R_D = \left[\frac{(V_{o,down} - L) \times G}{(V_o - V_{o,down})} - H\right]\Omega$$

1. Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of the module.
2. This is accomplished by connecting an external resistor between the Trim pin and either the +Output or -Output pins.
3. With an external resistor between the Trim and -Output pin, the output voltage set point increases.
4. With an external resistor between the Trim and +Output pin, the output votlage set point decreases.
5. The external Trim resistor needs to be at least 0.0625 W of rated power.

TRIM CONSTRAINTS

MODULE	G	H	K	L
RLPA15-XXS33	5110	2050	0.8	2.5
RLPA15-XXS5	5110	2050	2.5	2.5
RLPA15-XXS12	10000	5110	9.5	2.5
RLPA15-XXS15	10000	5110	12.5	2.5
RLPA15-XXS24	56000	13000	21.5	2.5

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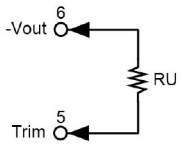
Output Voltage Adjustment (cont.)

EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method shown below.



□□S5

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	5.050	5.100	5.150	5.200	5.250	5.300	5.350	5.400	5.450	5.500
RU	(kΩ)	253.450	125.700	83.117	61.825	49.050	40.533	34.450	29.888	26.339	23.500

□□S12

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200
RU	(kΩ)	203.223	99.057	64.334	46.973	36.557	29.612	24.652	20.932	18.038	15.723

□□S15

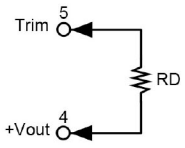
△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	15.150	15.300	15.450	15.600	15.750	15.900	16.050	16.200	16.350	16.500
RU	(kΩ)	161.557	78.223	50.446	36.557	28.223	22.668	18.700	15.723	13.409	11.557

△V	(%)	11	12	13	14	15	16	17	18	19	20
Vout	(V)	16.650	16.800	16.950	17.100	17.250	17.400	17.550	17.700	17.850	18.000
RU	(kΩ)	10.042	8.779	7.711	6.795	6.001	5.307	4.694	4.149	3.662	3.223

□□S24

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	24.240	24.480	24.720	24.960	25.200	25.440	25.680	25.920	26.160	26.400
RU	(kΩ)	570.333	278.667	181.444	132.833	103.667	84.222	70.333	59.917	51.815	45.333

△V	(%)	11	12	13	14	15	16	17	18	19	20
Vout	(V)	26.640	26.880	27.120	27.360	27.600	27.840	28.080	28.320	28.560	28.800
RU	(kΩ)	40.030	35.611	31.872	28.667	25.889	23.458	21.314	19.407	17.702	16.167



□□S33

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.970
RD	(kΩ)	116.719	54.779	34.133	23.810	17.616	13.486	10.537	8.325	6.604	5.228

□□S5

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	4.950	4.900	4.850	4.800	4.750	4.700	4.650	4.600	4.550	4.500
RD	(kΩ)	248.340	120.590	78.007	56.715	43.940	35.423	29.340	24.778	21.229	18.390

□□S12

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	11.880	11.760	11.640	11.520	11.400	11.280	11.160	11.040	10.920	10.800
RD	(kΩ)	776.557	380.723	248.779	182.807	143.223	116.834	97.985	83.848	72.853	64.057

□□S15

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	14.850	14.700	14.550	14.400	14.250	14.100	13.950	13.800	13.650	13.500
RD	(kΩ)	818.223	401.557	262.668	193.223	151.557	123.779	103.938	89.057	77.483	68.223

□□S24

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	23.760	23.520	23.280	23.040	22.800	22.560	22.320	22.080	21.840	21.600
RD	(kΩ)	4947.667	2439.333	1603.222	1185.167	934.333	767.111	647.667	558.083	488.407	432.667

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